

FALL AND WINTER ROOSTING HABITS OF CAROLINA CHICKADEES

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Although fall and winter roosting sites for some members of the genus *Parus* have been described, roosting habits of many species have not been thoroughly studied. During the months October 1972, through March 1973, I observed the types of roosts used by Carolina Chickadees (*P. carolinensis*), the frequency of use for each roost, the number of individuals using each roost, the relation of roost sites to flock ranges, the times of entry and departure, and the behavior of individuals prior to roosting and immediately after departure from roosts. A description of the fall and winter roosting habits of these chickadees is presented here.

METHODS AND STUDY AREA

Two adjoining farms in south Knox Co., Tennessee, served as the study area. The area was approximately 90 ha, about $\frac{1}{2}$ of which was wooded. The non-wooded area either was used for cattle pasture or was idle ground undergoing secondary succession. Wooded areas were mostly deciduous with several patches of conifers. Dominant deciduous trees included oak (*Quercus* sp.), hickory (*Carya* sp.), and tulip poplar (*Liriodendron tulipifera*); Virginia pine (*Pinus virginiana*) was the most abundant conifer. All wooded areas had been selectively logged during the past 20 years. Consequently, few trees greater than 35 cm in diameter were present. A dense understory was present in most of the deciduous woods. Margins of the wooded areas supported luxuriant growths of herbaceous plants. Elevation varied from 275 to 335 m above sea level.

To supplement natural roost and nest sites, I placed 50 dark green nest boxes on the study area in December 1972. Each box had a cavity 9.5 cm wide, 8.9 cm long, and 23 cm deep with a 3.2 cm diameter entrance 17 cm above the floor. Twenty-five of the boxes contained 5 cm of sawdust. The boxes were attached 1-2 m above the ground to living and dead trees of various sizes.

I scouted the area for potential roosting sites by listening for chickadee calls and observing movements in late afternoon as indicators of nearby roosts. Each site was observed for periods of 15 to 60 min either in late afternoon or early morning. Presumptive roosts were also checked by attempting to flush roosting chickadees. A site was defined as a roost if a chickadee entered and remained in late afternoon or departed in early morning or flushed during normal roosting time.

A cylindrical cloth net 15 cm in diameter and 35 cm long attached to a 4 m pole was used to capture chickadees as they flushed from roosts. McCamey (1961) style traps at feeders were also used. Each trapped chickadee received a USFWS band plus a unique combination of colored plastic leg bands. In this paper individual chickadees are referred to by the last 3 digits of their band number.

I estimated the winter population to be 40 chickadees; 27 chickadees were captured and banded. Most of the unbanded chickadees had ranges that extended considerably beyond my study area. I determined the extent of each flock range by plotting flock

TABLE 1
DESCRIPTION OF CHICKADEE ROOSTS

Roost number	Height of entrance (m)	Direction entrance facing	Size of entrance (cm)	Substrate
1	4.5	up	5.0	dead maple limb
2	2.5	E	3.0	rotting maple limb
3	4.5	NW	4.0	dead maple limb
4	3.0	W	5.0	hollow maple limb
5	1.0	up	6.0	hollow fence post
6	1.2	NW	5.0	fence post
7	1.2	NW	5.0	dead box elder snag
8	6.0	E	4.0	dead willow ^a limb
9	7.5	W	3.0	rotting willow limb
10	3.5	W	3.0	dead ash ^b limb
11	1.2	E	4.0	rotting box elder snag
12	2.1	S	5.0	loose bark on willow
13	3.0	SE	4.0	dead box elder snag
14	4.5	NW	2.5	hollow sycamore ^c trunk
15	2.5	S	5.0	dead box elder snag
16	3.5	W	4.0	dead box elder snag
17	6.0	S	4.0	dead box elder
18	5.0	N	4.0	dead box elder limb
19	2.5	E	2.5	dead sassafras ^d trunk
20	3.0	N	4.0	dead dogwood ^e snag
21	5.5	NE	4.0	dead box elder limb
22	7.5	S	6.0	loose bark on oak limb
23	9.0	W	4.0	rotting oak limb
24	2.5	S	5.0	split hickory trunk
25	2.5	N	4.0	rotting snag

^a *Salix* sp., ^b *Fraxinus* sp., ^c *Platanus occidentalis*, ^d *Sassafras albidum*, ^e *Cornus florida*.

movements on maps; this information was supplemented with data from observations of marked birds at feeders.

Light intensity measurements were made with a Gossen Lunasix light meter. Sunrise and sunset times were taken from the World Almanac (Long 1972).

RESULTS

Twenty-five chickadee roosts were found; each is described in Table 1. Chickadees were not observed roosting in sites other than natural cavities or enclosures resembling cavities. Table 2 summarizes the number of times I checked each roost, the number of nights each roost was used, and the chickadees captured at each roost. Each occupied roost contained only one chickadee at a time, although several chickadees might use a roost over a period of time. For example, at least 4 chickadees used roost 5. Individual chick-

TABLE 2
 FREQUENCY OF ROOST USE AND CHICKADEES CAPTURED AT EACH ROOST

Roost number	No. nights checked	No. nights occupied	Band no. of chickadee captured at roost
1	9	9	110
2	5	2	N. C. ^a
3	11	4 ^b	N. C.
4	10	8	107, 108
5	32	16	104, ^c 107, 110, 112
6	14	1	N. C.
7	18	3	N. C.
8	4	0 ^d	N. C.
9	8	6	N. C.
10	37	11	106 ^e
11	4	2	N. C.
12	4	2	N. C.
13	4	3	107
14	7	3	N. C.
15	5	1	N. C.
16	7	6	N. C.
17	2	1	N. C.
18	13	9 ^e	103
19	1	1	105
20	2	2	N. C.
21	4	2 ^b	109
22	12	2	N. C.
23	17	10	N. C.
24	8	1	N. C.
25	2	2	N. C.

^a No chickadee captured.

^b Roost was also used by Tufted Titmouse.

^c Chickadee captured twice at same roost.

^d Woodpecker repelled chickadee; see results.

^e Roost was also used by Brown Creeper.

adees are known to have used several roosts; chickadee 107 was captured at 3 roosts (Table 2). Although some roosts appeared to be favored over others, no roost was occupied every night. All chickadees captured at roosts were within their flock range.

Each chickadee flock range appeared to have an excess of suitable roosting sites. Many roost sites, such as loose bark and hollow limbs, were naturally occurring and had not been altered by chickadees. Other roosts had been excavated by chickadees or woodpeckers. Downy Woodpeckers (*Dendrocopos pubescens*), but not chickadees, were observed excavating roosts. However, during the spring months chickadees did excavate nest cavities. Additional unused natural cavities and previously excavated cavities were present. None

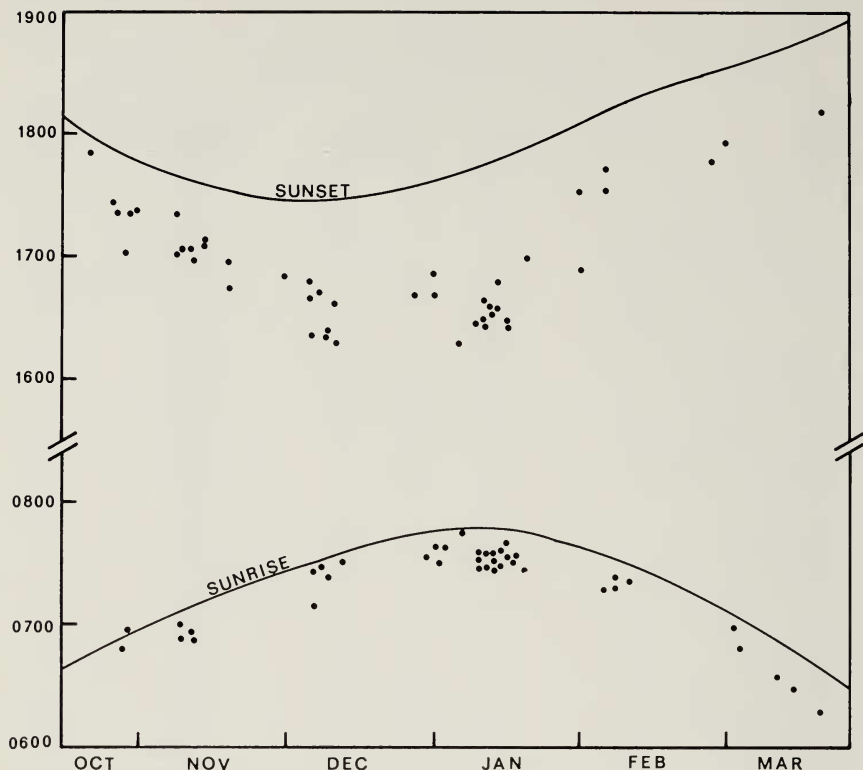


FIG. 1. Roost departures and entries in relation to sunrise and sunset.

of the nest boxes were used for roosts. None of the roosts I inspected contained any nesting materials, but most roosts did contain accumulations of feces. None of the roosts were used as nest sites the following spring.

Chickadees were observed departing from roosts 40 times and entering roosts 46 times (Fig. 1). Chickadees entered roosts before sunset and departed from roosts before sunrise. Light intensity was greater at entry than at departure. Chickadees varied entry and departure times in accordance with changes in daylength, but the precise times were variable. For example, entry times varied by as much as 32 min from 1 December through 11 December. Part of this variability was due to individual variation and part was due to weather. During inclement weather chickadees entered roosts earlier and departed later than on sunny days. Departure times were less variable than entries.

On several nights I observed a chickadee attempt to enter an occupied roost,

but the occupant always repelled the invader. Chickadees repelled from one roost usually departed quickly and in direct flight, apparently to another roost. I observed a Downy Woodpecker successfully repel a chickadee at roost 8. As the chickadee attempted to enter the roost the woodpecker emerged and attacked the chickadee. In an encounter of less than 5 sec several chickadee feathers were dislodged. The woodpecker then returned to the cavity and the chickadee displayed in high intensity Head-Forward posture (Hinde 1952) before moving away. Several of the other roosts were used occasionally by Tufted Titmice (*P. bicolor*), and one roost was used by a Brown Creeper (*Certhia familiaris*) for at least 3 nights.

The behavior of foraging chickadees changed as roost entry time approached. Flocks which were noisy and slow moving suddenly became silent as the individuals sat quietly or flew rapidly toward roosts. Choice of roost sites was apparently not determined by the flock location at roost entry time, as chickadees frequently made long flights, sometimes the length of the flock range, just prior to roosting. Most chickadees were alert and wary as they approached roosts. Occasionally a chickadee would enter a cavity at the normal roosting time, only to depart a few minutes later. I observed several sites that were briefly occupied, some on several occasions, only to be vacated and never used as overnight roosts. Disturbances, such as loud noises, at roost entry time apparently caused some chickadees to move to other sites.

Members of some chickadee pairs remain together through the winter (Brewer 1961) and possibly roost in the same vicinity. On several occasions 2 chickadees were observed traveling together toward a roost. As one chickadee entered the roost the second chickadee would explore the immediate area and would frequently remain in a site that appeared to offer very little protection. Two large sugar maples (*Acer saccharum*) with overlapping limbs contained roosts 1, 2, 3, and 4. On one night these 4 roosts sheltered 3 chickadees and 1 Tufted Titmouse. On 6 nights at least 2 of these 4 roosts were occupied.

The roosting position of chickadees was observed at roosts 10 and 23. These roosts were in short, hollow horizontal limbs. Each chickadee normally entered at an opening other than the terminal opening and then moved to within 5 cm of the terminal opening. The roosting chickadee usually crouched and placed its bill in its scapulars. On several evenings, the chickadee in roost 10 was observed crouching with its bill pointing forward. I frequently observed chickadees with bent rectrices in the mornings.

Chickadees were neither the first diurnal birds to begin daily activities nor the last to retire. Many passerines, such as Mockingbirds (*Mimus polyglottos*), Song Sparrows (*Melospiza melodia*), Rufous-sided Towhees (*Pipilo erythrophthalmus*), and Carolina Wrens (*Thryothorus ludovicianus*), were

active earlier in the morning and later in the afternoon. Tufted Titmice usually entered and departed roosts at about the same times as chickadees. Woodpeckers entered earlier and emerged later than the chickadees. During the shortest days of winter, chickadees frequently spent 15 hours per day in roosts.

Chickadees departed roosts quickly and silently, and they immediately began feeding and preening. Emerging chickadees did not carry feces in their bills. The first call notes were given 30 sec to 3 min after departing the roost, by which time a chickadee might have moved 100 m or more. Flock formation was initiated with the first call notes.

DISCUSSION

Chickadees on my study area apparently preferred natural cavities for roost sites; nest boxes and dense vegetation were abundant but were not used. Brewer (1963), in Illinois, found that Carolina Chickadees use sheltered branches and vines or cavities. Wallace (1964), whose study area was approximately 5 km from mine, observed chickadees roosting in cavities. Other members of the genus usually roost in dense foliage or small natural cavities (Odum 1942, Pielou 1957, Hinde 1952). Great Tits (*P. major*) in Holland roost in nest boxes (Kluyver 1950).

The number of available cavities may influence the choice of roost sites. Many box elder (*Acer negundo*) trees along Stock Creek, which flowed through the study area, rotting fence posts, and other dead trees provided an abundance of soft wood which could be easily excavated. Possibly in other areas the number of sites suitable for excavation was much smaller.

Failure of chickadees to use the nest boxes may have been partially due to the fact that nest boxes were erected in December by which time the chickadees had possibly selected their roost sites for the winter. Foraging flocks that I followed showed no interest in roost sites. Only once did I see a chickadee enter a roost cavity during midday; the cavity had, to my knowledge, not been previously used as a roost, but it was occupied that night. Chickadees probably explore new cavities, determine their potential as roost sites, and if suitable, return later. If such explorations occur primarily in late summer or early fall, newly appearing cavities would not likely be used unless a shortage of cavities existed.

The nest box cavities may also have been too large to serve as suitable roost sites. Although I was never able to inspect the interiors of some roosts, all of the roost cavities were smaller than the nest boxes, and some of the roost cavities were barely large enough for chickadees to enter. Flying squirrels (*Glaucomys volans*) began using some nest boxes shortly after the boxes were erected. Screech Owls (*Otus asio*) roosted in some of the woodpecker

holes. Encounters with these larger cavity dwellers may have forced chickadees to use small cavities.

Kendeigh (1961) showed that a solitary House Sparrow (*Passer domesticus*) was able to raise the temperature in its roost cavity on cold nights. Chickadees may also raise the roost cavity temperature. However, the degree of protection provided by chickadee roost cavities varied. Some roosts had solid walls with a side opening thus providing protection from both wind and precipitation. Other roosts had numerous openings and probably provided no better protection than dense foliage.

Each chickadee used different roosts during the winter. Roost site selection may be influenced by disturbances at roost entry time, proximity of the dominant mate's roost, and feces accumulations in roosts. If predators are attracted by the odor of feces in roosts, which seems likely, it would be advantageous for chickadees to change roosts frequently. Downy Woodpeckers and White-breasted Nuthatches (*Sitta carolinensis*), which keep their roost cavities clean, roost individually in the same sites each night (Kilham 1971).

SUMMARY

Carolina Chickadees (*Parus carolinensis*) were observed roosting only in cavities during the fall and winter months in Knox County, Tennessee. Twenty-five roosts are described. Each chickadee roosted alone and changed roosts frequently during the season. All captured roosting chickadees were located within their flock range. Chickadees entered roosts before sunset and departed before sunrise. Chickadees remained in roosts for as long as 15 hours during mid-winter. During inclement weather chickadees entered roosts earlier and departed later than on sunny days.

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